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Citrus Insect Control For July, 1956

Mediterranean Fruit Fly Due To Lax Quarantine Regulations

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Chandler Appointed Chairman FFVA Convention

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The Florida citrus industry is not "down and out" as some pessimists would have us believe — the industry is on a sound and firm foundation.

It is true that we face a serious, costly and possibly a long fight in the eradication of the Mediterranean Fruit Fly. We have faced and whipped that situation once before. We can do it again. It is true that we are facing another serious fight to exterminate the burrowing nematode, cause of spreading decline in our groves.

But, we have faced other serious threats and have won. We have survived freezes, hurricanes, insect pests and diseases and have become the world's leading producer of citrus fruits. It may be a long, rough road, but we will win our fight against the fly, and the nematode. The Florida citrus industry is a long way from being "down and out."

VOL. 37 — NO. 7 JULY, 1956 BARTOW, FLORIDA

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SPREADING decline can be effectively controlled by an application of D-D soil fumigant. Extensive tests have proved that the growth rate of young trees replanted in soil treated with D-D is more vigorous, and the yield is increased in size and quality over trees replanted in untreated soil.

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Stunted young citrus tree (left) grew in untreated soil. Tall, full tree (right) is in nematode-free D-D treated soil and will be a good producer.

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Citrus Insect Control

R. B. Johnson

For July 1956

W. L. THOMPSON,
R. M. PRATT
R. B. JOHNSON*
Florida Citrus Experiment Station, Lake Alfred

W. L. Thompson

The average level of infestation of all the major insects and mites is substantially above the five-year average at this time. There are, no doubt many factors responsbile for this situation, but it appears probable that the extreme drouth is the most important factor. The rainfall in May was a moderating factor, but it was not sufficient to improve the situation materially.

Purple mite infestations are at the highest level yet recorded (32.7% on June 22). Unless rains are heavy and continuous, this mite will continue to be a problem in July.

Red scale infestations are also at a record high level and will be high in the summer months and another outbreak in October and November is expected. The summer peak will be reached early in July. Purple scale infestations were low through May, but a heavy hatch in June has raised activity to a high level. The peak of infestations will be reached before the middle of July. A very high percent of both red and purple scales are in the younger stages at the time this was written, and the situation will still be favorable for control in the first half of July.

Rust mite is increasing somewhat earlier than usual and populations will be high in July.

SPRAY PROGRAM

It looks as though we will have to throw the book at the scales and mites this summer. As indicated in the activity table, the major pests are all on the high side. This year it is very important to keep the trees as free of scales and mites as possible because some groves are in a weakened condition as a result of extended dry weather, even though they may seem to be in good condition at this time.

*Written June 25, 1956. Reports of surveys by Harold Holtsberg, Cocoa; J. W. Davis, Tavares; K. G. Townsend, Tampa; T. B. Hallam, Avon Park; and L. M. Sutton, Lake Alfred.

Particular attention should be paid to red scale. Last year it was necessary to respray large acreages in the fall because of red scale infestations and usually the heaviest infestations were in groves sprayed in June or early July. It is suggested that where only light to medium infestations are present in early July that the scalicide application be delayed until mid-July or later. Where red scale is very noticeable then the scalicide should be applied as soon as possible because when a high percentage of fruit and leaves become infested, control is difficult. Since red scale thrives on exposed parts of the trees, do everything possible to spray tree tops as well as other parts of the tree thoroughly. Purple scale, of course, should not be taken lightly this year but timing of the scalicide is not quite so critical as for red scale. On the central East Coast, the summer control of purple scale is not so important if a scalicide was applied during the winter or spring.

Purple mite control has been effective later into the fall where oil sprays were applied in late July than when they were applied early in July. However, the effect of oil sprays on solids in the juice and retarding coloring where late July or early August sprays are applied should be considered.

The control of greasy spot should be considered where it has been a problem. It is again stressed that, because of the weakened condition of trees, everything should be done to keep as many leaves on the trees as possible.

Scale Control: Oil emulsion remains the best spray where a combination of scale, purple mite and mild infestations of greasy spot are to be controlled but it also is a shock to trees, especially those in a weakened condition. The combination of oil emulsion 0.7% oil plus 1 pound of 15% parathion or its equivalent is an excellent scalicide and will also control purple mite and mild cases of greasy spot. However, the mixture of oil and parathion is likely to cause as much leaf drop as 1.3% oil if applied under adverse conditions, but it does not affect solids and fruit color as much as full strength oil. A combination of 0.7% oil plus 2 to 3 pounds of 25% malathion might be tried in an experimental way since this combination shows promise as a good scalicide without as much hazard as parathion. Parathion 1.7 pounds, or malathion 3 to 5 pounds per 100 gallons can also be used and are especially suitable where high solids and good color are desired and these materials cause very little shock to the trees. Parathion or malathion is especially recommended for early varieties of oranges, grapefruit and for tangerines. If oil is to be used on tan-

(Continued on next page)

SCALE AND MITE ACTIVITY BY DISTRICTS*

District	Purple Scale	Red Scale	Purple Mite	Rust Mite on leaves	Rust Mite on fruit
West Coast	5.08	2.69	2.31	1.40	——
Indian River	4.52	4.37	2.13	1.27	——
Upper East Coast	5.00	5.00	1.20	1.50	——
Gainesville	5.80	4.16	2.84	.67	——
Orlando	4.44	4.41	2.25	1.40	——
Brooksville	5.41	4.21	2.69	1.30	——
Ridge	4.66	5.61	2.72	2.06	——
Bartow	5.67	4.62	2.00	3.38	——
State Average	4.99	4.53	2.35	1.65	1.65
Last Year	4.73	3.11	1.65	1.31	1.36

* Third week in June. Activity is computed from populations, amount of hatching of scales, and number of groves with increasing or decreasing infestations. Activity is considered high if above 4.0 for purple scale, 3.0 for red scale, and 1.5 for mites.

Chandler Appointed Chairman F. F. V. A. Convention

Luther L. Chandler, Goulds, has been appointed chairman of the 1956 convention of the Florida Fruit & Vegetable Association, according to

LUTHER L. CHANDLER
OF GOULDS

an announcement by Rudolph Mattson, Ft. Pierce, president of the organization.

"The 3-day meeting will be held at Hotel Fontainebleau, Miami Beach, opening on Thursday September 27, Mattson added.

"We are pleased to announce that Mr. Chandler, a member of this association since its formation in 1942, has accepted our appointment as general chairman for our 13th Annual Convention.

"In each successive year, this Association has established new highs in attendance and programming so there is now a real need for Mr. Chandler's talents in realizing the goal for our 1956 meeting."

Chandler commented on the magnitude of the appointment and called on all members of the Association and allied industries to forward suggestions for making the coming event of utmost interest to all participants.

"The purpose of the convention is to bring together representatives of phases of the fresh fruit and vegetable industry of this state with others on the national and international level so that mutual problems may be solved and new ideas advanced. The annual membership meeting and elections are also held during the convention. It is therefore one of the most important events in the industry and we look forward to this challenging assignment," Chandler said.

CITRUS INSECT CONTROL FOR JULY, 1956 . . .

(Continued from preceding page)

gerines do not use more than 1% oil.

Purple Mite Control: During the summer, an oil spray is the most effective material. For effective control, do not use less than 0.7% oil. The organic miticides can be used but the period of control in the summer is very short.

Rust Mite Control: Rust mite infestations in July are likely to be heavy. A combination of 1 gallon of lime-sulfur plus 5 to 8 pounds of wettable sulfur can be used on all varieties except Hamlins, Temples and tangerines. If scale control is desired, add 1.7 pounds of parathion per 100 gallons to the lime-sulfur-wettable sulfur spray. Wettable sulfur 8 to 10 pounds per 100 gallons can also be used, especially on varieties that lime-sulfur may burn. Sulfur dust may be used if a thorough application is made on two sides of the trees. Sulfur dust is desirable to reduce rust mite infestations where it is necessary to follow with oil in a short time because it is more easily washed off the trees than where a sulfur spray has been applied.

Greasy Spot Control: Greasy spot is usually more of a problem on grapefruit trees and young trees of any variety, but any variety of citrus may be severely affected. For light to mild cases oil emulsions usually give good control. Oil sprays are especially recommended on oranges that are to be sold for fresh fruit because copper may cause star melanose if the fruit has melanose lesions on it. On grapefruit, young trees, and orange trees where the fruit is to be processed, a copper spray is effective and may be added to oil or wettable sulfur. For early July sprays, use about 0.4 of metallic copper in the form of a neutral copper per 100 gallons with wettable sulfur and parathion if scale is to be controlled. If the application is delayed until late July or early August 0.3 of a pound of metallic copper is sufficient. If a copper-oil is used, about 0.2 of a pound is sufficient. A very effective program has been an early July oil application followed in four to six weeks with about 0.2 of a pound of copper plus wettable sulfur. Be sure to make the second application by the middle of August. An early July copper 0.15 pound plus wettable sulfur per 100 gallons followed by a second application by mid-August is also very effective.

For more detailed information refer to the 1956 "Better Fruit Program" or consult the Citrus Experiment Station at Lake Alfred or Fort Pierce.

Pull-Treat Slows Spreading Decline

FRANK B. BORRIES, JR.

Growers are well aware of the serious threat to Florida citrus groves posed by spreading decline and research workers at the Citrus Experiment Station and others are seeking effective and practical control measures. Citrus Station workers have obtained sufficient information to indicate that the pull-and-treat method — removing the trees and fumigating the area — will stop the trouble in most instances. This method is recommended until a better one is found, and the State Plant Board is aiding growers in carrying it out.

To date, a total of 42 species and varieties of citrus have been used as rootstocks and budded to Valencia orange. Two field plantings, one in 1953 and the other in 1955, have been established on infested soil to determine the reaction of these rootstocks to the burrowing nematode under field conditions. An intensive study also is being made of selected trees that appear to have escaped nematode damage in infested areas.

Lychee trees, incidentally, have been a surprise. Test lychee trees were planted in infested land and examined for three years. "But the burrowing nematode never have been found infesting the roots of these trees, although adjacent citrus trees were heavily infested," says a Citrus Station report.

Experimental efforts to infest lychee roots of seedling and rooted cuttings also have been negative. The scientists conclude that the lychee is immune to burrowing nematodes.

The experimenters have found that burrowing nematodes were infesting trees one to six rows in advance of the visibly affected area. The annual rate of spread from a center of infestation varied from no spread at some points on the periphery to 180 feet at others.

Spread of the disease downhill apparently is faster than uphill, the experimenters noted in some groves. In one place where the nematode margin had been determined, there was no spread uphill, but downhill it was about 180 feet in one year.

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Mediterranean Fruit Fly Due To Lax Quarantine Regulations

. . . By . . .
W. W. (BILL) CARMICHAEL
PERRINE, FLORIDA
. . . At . . .
SUB-TROPICAL FRUIT INSTITUTE,
LAKE PLACID

It should clearly be understood that the author is not a Scientist and that this paper is based on three years of research, reading and inquiry on Mediterranean Fruit Fly, and other Insects that seriously threaten Florida's agriculture economy. It is also based on two and a half years of continuous effort to strengthen quarantine controls on the import of foreign plant materials.

When I was first approached to present this paper my suggested subject was the dangers of Importation of Mediterranean Fruit Fly into Florida due to lax quarantine regulations. Since that time I'm most unhappy to say probable importation has become fact.

It is interesting to note a paragraph in Dr. F. S. Bodenheimers Entomology of Citrus. He states and I quote, "The spread of major insect pests throughout the world varies in direct proportion to man's speed of locomotion", unquote. In other words our modern air travel has increased the danger of encroachment of dangerous insects to an alarming degree. Another factor in this respect is the enormous increase in tourist travel and the inherent desire of the traveler to bring home fruit specimens from the far places. Few people realize the tremendous damage possible from a single infected fruit.

As The Citrus Industry goes to press the Medfly has been definitely found in eighteen Florida counties, mostly in the Southern section but extending into the Central and Middle East Coast areas. Spraying of infested areas by airplane is going forward daily and the work is going forward as rapidly as men, machines and material can do the job. It is a serious siutation, but State and Federal authorities are putting forth every effort to effect eradication as quickly as is humanly possible. It is a hard, costly, and may be a long fight, but officials in charge are apparently doing a good job.— Editor.

Fruit Fly Described

It is probable almost every person in Florida by this time would recognize the Mediterranean Fruit fly by description. However for the benefit of anyone not familiar with this insect it seems advisable to review some of the more pertinent facts.

Mediterranean Fruit Fly (Diptera-Ceratitis Capitata) is slightly smaller than the common house fly. It is brightly colored with shades of yellow, light orange, browns, and black in a mottled pattern of both wings and body. It is most distinctive in appearance and easily recognized in the adult stage. This however is unfortunately not true of the larvae. Since there is a close resemblance of most larva of the Diptera family it becomes necessary to make microscopic identification. This should be entrusted only to a qualified Entomologist.

Most Fruits Are Hosts

It is far easier to list non-host fruits than to list the ones affected by this insect. Of all the fruits grown in Florida, the pineapple appears to be the only immuned species. Peaches, plums, and all of the soft deciduous fruits are affected. Of our South Florida fruits the surinam cherry, and the Calomondin are probably its first loves. Grapefruit, and orange, particularly late maturing types are on the number one host list, with the mango a close second. Limes are

only affected in the ripe yellow state, there is no record to my knowledge of field infestation. They however are considered hosts since the maggots thrived in these fruits after introduction in the laboratory. Guavas, sapotes, sapodillas, Avocados, figs, loquats, papayas, and even the lowly prickly pear, and coco plum are serious hosts.

The adult fly alights on the surface of the fruit puncturing the skin with the ovipositor, a hallow tube like organ for the depositing of the eggs through the skin of the fruit. The average number of eggs deposited in a single puncture seldom exceeds twelve to sixteen. This procedure is repeated usually on two or more portions of the same fruit, then a new fruit is attacked. In temperatures of seventy degrees or over the egg hatches very quickly, becoming a full grown maggot in seven to eight days. The maggot after hatching burrows through the remaining skin tissue into the pulp of the fruit on which it feeds. The serious internal damage done by the maggots usually causes the infected fruit to drop to the ground. The adult maggot leaves the fruit, burrows slightly below the surface of the soil and goes into the pupae stage. In this stage, development varies considerably according to temperature, and season of the year. However, Wied and Bodenheimer agree that the average time in the pupae stage is about eight days. At which time the adult fly breaks from the protecting pupae shell and emerges, to begin the cycle again. It should be noted that according to the best authority, the life cycle is complete in fifteen to twenty-one days, in temperatures prevailing in our latitude.

Widely Distributed

Geographically speaking the Mediterranean Fruit Fly is one of the worlds most widely distributed insects. From the standpoint of climate it could easily spread and thrive over the entire Southern half of the United States. Its present distribution envelops most of the land masses between the fortieth parallel South, and the fortieth parallel North of the equator. We here in Florida however are most concerned with the infestations in the Western Hemisphere. Most of the South American Continent has been ravaged by this fly. It has been found in the major portion of Central America (Trinidad, Aruba, Haiti, Controrersial, Puerto Rico, Jamaica, and many of the smaller islands of the West Indies). At the present time we have no concrete proof of its presence in Cuba. The last survey on this island was completed two years ago, and by our own experience one will realize this survey is obsolete. Inspection of mangos in 1954 in Cuba revealed reasonably high infestation of fruit fly maggots, which the author for lack of equipment could not identify. This infestation may or may not have been Mediterranean Fruit fly. Under the circumstances imports from Cuba to Florida should be regarded with suspicion. There seems no question in anyone's mind as to the method of introduction of Fruitfly into Florida. An official of the United States Department of Agriculture at a hearing in Miami, Florida, stated that the United States Department of Agriculture had intercepted 270,000 contraband lots of fruit entering the United States from quarantined countries. Of the 270,000 interceptions 11,000 were infested with Mediterranean Fruit fly. These interceptions were on an approximate 10% inspection basis. From this report we might assume that 110,000 entries of infested fruit would take place along the boundaries of the Continental United States per year. This figure may amaze the public, but is thought to be very near to accurate by the Florida State Plant Board, and certain Agriculture officials. It is only necessary to bring in one contaminated fruit, discard it in an area where host fruits are present to create an established infestation. At the time of writing, seventy distinct infestations have been located in the Miami area. It is the opinion of the writer that these seventy locations are for the most part independent of each other, and almost wholly from separate contaminated fruit introductions.

At the Customs House

A trip through customs on entering the United States from the South is a most interesting experience. One is herded along with the rest of the passengers, after your plane lands, into a bare room with long low tables for baggage inspection. There were seventy persons entering the United States from the West Indies in our particular case. Three Customs Inspectors were present. We were asked if we had any merchandise to declare, and particularly if you were bringing in any rum. I personally was never asked whether I carried any plant material, or was any interest shown in making an inspection of my baggage. The only interest shown was in manufactured goods, or taxable liquor. A Florida State Plant Board Inspector was present, but was given no cooperation or opportunity to check baggage in an adequate manner. The entire inspection by the three agents required twelve minutes. One of the three inspectors took no part in checking baggage. One hundred and thirty seven pieces of baggage were involved in this twelve minute, two man fiasco. The entire idea was to collect on their liquor and get them out of here. This procedure is typical of the conditions at Miami International Airport, and have been for more than two years. The volume of business through Miami constitutes the arrival of a plane from Latin America every eight and a half minutes around the clock, by Pan American Airways statement.

Late in 1953 National economy struck the Customs Department, and the United States Department of Agriculture. The number of inspectors in all ports of entry was based on the amount of money in customs duties they could collect, need of proper inspection did not enter the case. Shortly thereafter it became apparent the customs had no desire to do the Department of Agriculture police work.

On May 12th, 1956, on direct order from Washington, the Customs Department returned to a hundred per cent baggage inspection schedule. This of course is highly desirable but is an excellent example of the old adage of locking the stable after the horse is stolen. There still remains two important sources of pest introduction which are still either inadequately checked or not checked at all. First of these is the large number of private aircraft, and pleasure boats entering Florida from Latin America and the Indies daily. Many of these aircraft land at airports where proper customs check is slow or not available at all. In these cases the only official interest is illegal entry of manufactured goods. Second, is the large number of military aircraft entering this State from all over the world with no inspection whatsoever. On many occasions I have seen fruit brought in by military personnel from the worse infested areas of the world. It is therefore imperative that the military be acquainted with the

dangers involved, and given authority to police their own personnel in this respect or to allow proper inspection by the United States Department of Agriculture, or customs officials.

The Florida Fruit and Vegetable Growers Association, The Florida Mango Forum, The Florida Lime Council, and the Florida Avocado Growers Association, made representation to all members of the Florida Congressional Delegation in Washington together with the United States Department of Agriculture, protesting lax inspection and poor cooperation with Florida State Inspectors. We were joined in this fight by Mr. Ed L. Ayers, Florida State Plant Commissioner. Letters of protest were followed by briefs setting forth the serious danger presented by this situation. Mr. David Stubinger, Assistant Commissioner of Customs, fired back denial of the responsibility of the customs department for plant materials inspections. He made his position quite clear in this matter. Protests were filed to the Department of Agriculture putting forth denial by customs officials of their responsibility. The Department of Agriculture claimed they had insufficient money appropriated for this purpose. This was the beginning of a long session of official buck passing. Every Agricultural and Horticultural Organization representing the South Florida Vegetable and Fruit Industry continued their protest. Copies of much of this matter was sent to the Florida State Plant Board Office, and to the Governor of the State. We were informed many times that we were dealing entirely on theory. I, personally was informed along these lines many times. I made the assertion in the County Agents Office, of Dade County in 1954, before a Department of Agriculture Committee that Florida would have a full scale Fruit Fly invasion in two years. This statement was based on intensive study, and a personal check of the situation in Latin America. Our officials now raise their hands in horror that such conditions could possibly exist. In truth if they bothered to read their mail and to appraise protests made by qualified agriculture associations we would not find ourselves in this predicament today. It is difficult to understand the thinking in Washington that would permit cutting off proper inspection as an economy measure. The basic economy of the State of Florida, and half of the Nation is at stake. Unfortunately the grower is only thought of as important person, when the nation's food supply is threatened by war. Agriculture in the United States is its largest single industry. This government thinks nothing of spending fifty billion dollars abroad, but can't afford proper quarantine measures to protect our agriculture at home. The total of Florida's agricultural industry brings an annual income to this State of almost one billion dollars. Most of which is invested in Florida, and stays in Florida. It is doubtful that the tourist industry contributes an equal amount that stays in this state. It is hard to hazard a guess on the cost of eradication of the present invasion. The cost in 1929, and 1930, of eradication was $6,858,636.95 from the Federal Government. The State of Florida contributed $383,000.00 bringing the total cost to more than seven million dollars. The infested area in 1929 consisted of 1600 square miles. At this time the infested area consists of more area than in 1929 with new areas of infestation being confirmed almost daily.

The question is how to prevent re-infestation, if and when total eradication is achieved. I have heard various theories put forth, but in my opinion the only means of protecting ourselves from this pest is total embargo of fresh fruits from outside continental United States. Fumigation of fruits by Ethylene Dibromide, is claimed by the Department of Agriculture to be adequate. But by their own admission at recent hearings is only 98.2 per cent effective.

It will be difficult to affect such an embargo on a national scale, if not impossible. The State Department would most certainly not stand for such infringement on their foreign trade agreements. For many years all efforts of the State Department have been to encourage foreign imports with no regard on its affect on domestic production. State Department pressure has influenced many policies of the Department of Agriculture. Had it not been for the joint effort of South Florida Agriculture Organizations, Port Everglades, Jacksonville, and Tampa would be the ports of entry of most fresh fruits shipped from Latin America. These groups were successful through the cooperation of our Florida Delegation to prevent this wholesale influx through our state. We also succeeded in forcing fumigation on fresh fruits entering designated ports, in commercial quantity.

There is immediate, and imperative need to place quarantine regulations and enforcement under the jurisdiction of a single agency of government, and setting up funds for operation, and policing. There should be an advisory committee from the Agriculture Industry, with powers to make recommendations to the Department of Agriculture. This Committee should include the Florida State Plant Commissioner, as well as at least two members of the Florida State Plant Board. A committee of this type could be of great value to the Agriculture Department in setting up, and maintaining regulations acceptable to the industry. Under the present setup the Industry carries the expense in taxes, and gets no tangible returns.

Under Federal quarantine regulations, a strict fumigation program will be enforced, in areas adjacent to infested areas under embargo. Pressure should be exerted by the Industry to obtain fumigation chambers, and equipment for the fumigation of trailer-truck cargoes. This I have been informed is a Federal obligation. Unless immediate action is taken on this matter, much fruit will spoil in the groves before Government red tape unravels.

I wish to extend the thanks of the Tropical Fruit Industry to Mr. Ed L. Ayers, Florida State Plant Commissioner, for the practical common sense approach made in this emergency. Mr. Ayers has been for many years highly respected by the Agriculture Industry, and it is with confidence that we enter an all out fight to eradicate Fruit Fly under his leadership.

I wish to express my thanks to Dr. F. Gray Butcher, Research Entomologist of the University of Miami, for his kind assistance in making the research material available for this article.

References:

Dr. F. S. Bodenheimer—Citrus Entomology.

Sargeant—Flora, and Fauna of Bermuda.

Quayle — Mediterranean Fruit Fly-Report of University of Califorma.

Searle—British Museum of Natural History—Insects of Southern Europe.

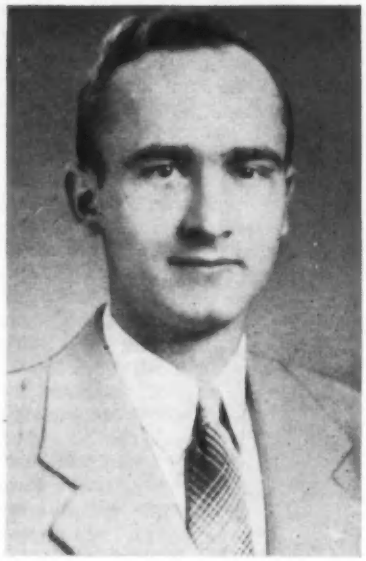
Dr. F. Gray Butcher—Research Entomology—University of Miami.

Dr. N. O. Berry—United States Department of Agriculture — Entomology Section.

Can Irrigation Lessen Citrus Fruit Drop?

Can the grower increase young citrus fruit retention by irrigating during the annual drop period? It is well known that an obvious deficiency of soil moisture, among other factors, will cause very young citrus fruit and even fruit more than 1 inch in diameter to drop. However, very little attention seems to have been given to the degree of soil moisture deficiency which will result in excessive fruit loss during the spring drop period.

During the Spring of 1955 the College of Agriculture grove at Gainesville—on deep, well-drained Arredondo fine sand—was used for a study of fruit drop of Hamlin oranges in relation to soil moisture. On April 25 eight 15-year Hamlin trees were chosen at random, and 50 fruit per tree, in a 5-foot band encircling the tree 3 feet from the ground, were tagged. Four trees were irrigated on three oirasions when the soil moisture tension at 1 foot reached 800 cm. of water under 3 of the 4 trees. Three soil moisture tensiometers had been installed under each tree in March. Two tensiometers were at depths of 1 and 2 feet at the trunk, and 1 tensiometer was at a depth of 2 feet midway between the edge of the tree canopy and the trunk. Rainfall data were taken with an official U. S. Weather Bureau guage.



L. C. HAMMOND
ASSOCIATE SOILS PTYSICIST

The rainfall for the period January through June is given in Table 1. Tensiometer readings on irrigation dates and on 1 or 2 days after each irrigation are presented in Table 2. Rainfall was deficient from early April to May 23 and again in early June. This was reflected in the tensiometer readings. A high reading (850 is the limit of the instrument) indicated that the moisture supply was near the wilting point. A low reading indicated that plenty of moisture was available. It is of interest to note that in most cases the tension at the 2-foot depth was less than 800 when irrigation was applied. Where the trees were not irrigated some tensiometers still indicated that moisture was available during the dry periods, but most units gave high readings and then went out of operation. However, none of the non-irrigated trees showed any definite wilting during the period of the study.

TABLE 1.—Rainfall at Gainesville Florida during the period January 1, 1955, to June 30, 1955.

Date		Rainfall inches
Jan.	10	0.05
	11	0.05
	17	0.28
	19	0.51
	23	0.33
	24	1.97
	25	0.45
		3.64
Feb.	7	1.74
	8	0.61
	11	0.91
		3.26
Mar.	23	0.38
	28	0.05
	29	1.23
		1.66
April	3	0.69
	6	0.04
	11	0.06
	14	0.14
	15	0.32
		1.25
May	10	0.03
	11	0.16
	16	0.20
	17	0.57
	21	0.03
	22	0.16
	23	1.04
	24	0.18
	28	0.03
	30	0.10
		2.58
June	11	0.72
	12	0.90
	16	2.77
	17	0.20
	18	0.37
	19	0.04
	24	0.20
	25	0.33
	26	0.03
	27	0.59
	28	0.09
	29	0.80
		7.04

The application of irrigation water under these conditions apparently helped to hold more fruit on the tree, as indicated by the data of Table 3. The differences on May 4 were not significant when subjected to statistical analysis, but they were significant on May 18. A tremendous shedding of fruit occurred between May 4 and May 18. From May 18 to September 8 only six fruit were lost from each treatment. Obviously the third irrigation was of little value. Also, it is apparent that more fruit had set than could be brought to maturity on these trees.

TABLE 3.—Percent of tagged Hamlin orange fruit dropped with 2 irrigation treatments.

Treatment	Tree Number	Fruit Dropped1 May 4	Fruit Dropped1 May 18
		%	%
Irrigation2	13	12	44
	4	14	60
	1	24	80
	8	6	62
Average		14	62
No Irrigation	6	32	82
	3	8	86
	10	48	98
	7	44	100
Average		33	92

1. Percent of 50 tagged fruit per tree.
2. Approximately 3 inches of water applied with sprinklers during a 2¼ hour period on April 25, May 8, and June 1.

The resulting fruit crop, however, appeared to be low to medium for this grove. Factors other than moisture may have had a predominant influence—for example, cold weather in March.

It is also possible that the irrigation was delayed too long for maximum fruit retention. Future studies should include irrigation at lower soil mosture stresses. In addition, the relationship between quantity of fruit set and the effective-

(Continued on page 18)

Cailomenes Sexmaculata F., An Imported Beneficial Ladybeetle

ALLEN G. SELHIME
AGRICULTURAL RESEARCH SERVICE, USDA, ORLANDO

Chilomenes sexmaculata F. is a beneficial lady beetle collected in India in 1954[1] and sent to the Pink Bollworm Research Center at Brownsville, Texas., where it is being reared for release against the cotton aphid. Chilomenes feeds on aphids, various stages of white-flies (Kapur 2), eggs of the sugarcane leafhopper (Rahan and Nath 3), and nymphs of the corn lantern fly (Bagal and Trehan 1).

On May 26, 1955, the fruit insects laboratory in Orlando received a shipment of 50 adult Chilomenes lady beetles from Brownsville. They were placed in a rearing jar containing leaves infested with citrus aphids. The first eggs from these beetles were seen on May 30.

For rearing the lady beetles field-collected terminals and leaves containing aphids are placed in gallon glass cooky jars. Eggs laid on the leaves are removed at regular intervals to keep them from being eaten by the adults. The terminals and leaves are removed after the aphids have been eaten.

Chilomenes eggs, which are yellow and cylindrical with tapered, rounded ends, are laid singly or in clusters on the under sides of the leaves, and hatch in 2 to 3 days. The first-stage larva is black, but after the first molt it acquires yellow markings along the back. The larvae molt three times, and during their entire larval stage they are very active and feed voraciously. According to Begal and Trehan (1), individual larvae consumed a maximum of 303 aphids in their development. In 6 or 7 days they pupate, usually on the under sides of leaves. The pupa is yellow with a thin black margin on the wing pads and two rows of black marks down the abdominal segments. The adults emerge in 2 or 3 days, and on the third or fourth day after emergence they begin to lay eggs. Begal and Trehan state that the numbers of eggs laid by two females in the laboratory were 2,384 and 3,765. In our laboratory eleven lady beetles completed development from egg to adult in 11 to 12 days at a mean temperature of 82.5° F (range 78.5 to 86.5°). The life cycle is remarkedly short for a lady beetle.

The adult beetles are tan with black markings and about 3/16 inch long. They turn darker with age and become more of an orange-cinnamon color. Bagal and Trehan (1) found that the adults lived about 6 weeks and one adult consumed 16,321 aphids, eating 60 to 84 per day. In one group of our breeding stock some adults lived only 6 days, but one female died 69 days after emerging.

We have fed both adults and larvae on field-collected citrus aphids when they were available, but have substituted aphids found on weeds when citrus aphids were difficult to find. The aphids used were the spirea or green citrus aphid, (Aphis spiraecola Patch), the melon or cotton aphid (A. gossypii (Glov)), the black citrus aphid (Toxoptera aurantii (Fonsc.)), and Macrosiphum ambrosiae (Thos.) found feeding on the grass-leaf wild lettuce (Lactuca graminifolia (Michx)), and M. onagrae Patch found on the weed Gaura angustifolia Michx[2].

We have made 13 releases of Chilomenes in Florida. We released 772 adults in eight localities in orange County, and from 47 to 143 in one locality in each of the following counties: Lake, St. Lucie, Indian River, Marion, and Seminole. Most of the groves for the releases were selected with the aid of county agents[3], groves on a no-spray program being chosen to give the beetles the best possible chance for survival. Temple oranges and tangerines were usually selected, as they put out new growth more readily and furnish a better supply of aphids than other varieties. Recovery studies to see if the beetles have become established will be made during the spring flush of growth.

We believe that chilomenes sexmaculata will be a very welcome foreigner, and we hope that it will establish itself readily in Florida. Its short life cycle, known host list, large appetite, and egg-laying capacity should make it a promising factor in the battle against citrus insects as well as against insects on vegetables and ornamental.

REFERENCES SITED

1. Bagal, S. R., and Trehan, K. N. 1945. Life history and bionomics of two predaceous and one mycophagus species of Coccinellidae. Jour. Bombay Hist. Soc. 45(4): 566-575.

2. Kapur, A. P. 1940. A note on the lady-bird beetles predating upon the cane whitefly **Aleurolobus barodensis Mask.** Current Sci. (India) 9(3): 134.

3. Rahan, L. A., and Nath, R. 1940. Vionomics and control of the Indian sugar-cane leafhopper, **Pyrilla perpusilla** Wlk. in the Punjab. Bul. Ent. Res 31 (2): 179-190. London.

(Reprinted from proceedings of Florida State Horticultural Society.)

1/By George W. Angelet, of the Entomology Research Branch.

2/These weeds were identified by Erdman West, of the University of Florida.

3/Robert E. Norris of Lake County, Jack McCown of Indian River County, and Henry Swanson of Orange County.

The average American eats his weight in food every six to eight weeks.

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Let Plants Carry Poison Bug Juice!

L. C. KUITERT AND
S. H. KERR,
ENTOMOLOGIST AND ASSISTANT

For some time entomologist have envisioned controlling insect by introducing a poison into the plant's vascular system. The poison then would be carried to all parts of the plant, making it toxic to insects feeding on it.

Such chemicals, absorbed and translocated through the sap stem, making all parts of the plant toxic to insects, are systemic insecticides.

This dream was partially realized in 1933 when Gnadinger[1] used selenium to control various species of red spiders infesting such greenhouse plants as asters, gladiolus, and carnations. Selenium eventually came to be used by some nurserymen for controlling mites, thrips, aphids and foliar menatodes. Its use was restricted by its extreme toxicity to warmblooded animals and its stability, which kept it present in plant tissues in toxic form for long periods.

Shortly after World War II, Schrader (2) reported that a number of phosphatic compounds were absorbed readily by growing plants, and that these were translocated to all parts of the plant, making plant juices and tissues poisonous to insects.

One of these is demeton (Systox). It appears to break down in five to eight weeks when applied to the soil. Thus a vast new field of insect control is opened. It has tremendous possibilities.

Absorption of demeton and similar compounds may take place through the roots, the aerial parts and even the seed. Many investigators have shown that systemics absorbed by the roots are translocated to all parts of the plant—mostly upward into the aerial portion.

Florida Tests

Demeton has given outstanding control of sucking insects—aphids, whiteflies and mealybugs—and good to above-average control of the soft scales and most of the armored scales on ornamentals in Florida. It is especially effective in controlling the immature stages of soft and armored scales. It has been outstanding in controlling many spider mites and bulb mites. Treated plants have been free of mites for six to eight weeks. It is not particularly effective against chewing insects.

On ornamentals we have applied demeton mostly as a foliage spray. Rate of application in most cases was one-half to one pint of 22 percent demeton emulsion concentrate per 100 gallons of water. Drenching the soil with a dilute concentration works well in many cases, too, since demeton is absorbed through plant roots.

Ornamental plants on which insects have been successfully controlled in tests here include camellias, azaleas, gardenias, hibiscus, pyracantha, roses, palms, and various annuals including chrysanthemums, Easter lilies, gladiolus, ivy, and African violets.

None were injured by demeton at recommended dosages. Use of demeton is safe on a number of other ornamentals, it was shown.

In some tests, where demeton was applied as a soil drench to gardenias, a considerable improvement of the root system was noted. The demeton could have controlled nematodes directly; it could have been absorbed into the plants, making them resistant to nematodes; and it may have had some nutritional effect.

Recent tests showed that drenches and sprays of demeton are very effective in controlling aphids and mites infesting chrysanthemums. The rapidly growing chrysanthemum industry has turned largely to use of demeton for such control. Demeton has been used successfully to clean up mite infestation on azaleas by applying it through the overhead irrigation system.

Demeton has many other uses, too. In other tests at Gainesville, demeton applied at one-half and one pint of emulsion concentrate in only 6 gallons of water per acre gave outstanding control of mites infecting white Dutch clover. It has been tested successfully in several places in Florida on various vegetable crops and has proved effective against citrus pests in California.

Demeton has Federal tolerances and approval for use on apples, broccoli, brussels sprouts, cabbage, cauliflower, muskmelons, oranges, pears, potatoes, and walnuts.

1. Gnadinger, C. B.—Selenium—Insecticide Material for Controlling Red Spider. Ind. and Engineering Chem. 25: 633. 1933.

2. Schrader, G. Nitrogen-containing phosphoric acid derivatives as contact insecticides and materials for the internal therapy fo plants (translocation). British Intell. Obj. Sub-Comm. Final Report 1095. 1947.

More Than Half Of Rural Boys Not Benefitting From Organized Activities

More than half of all rural boys 8 to 18 years of age are on their own—without participation in such organized groups as Future Farmers of America, 4H Clubs, Boy Scouts of America, and other youth groups, J. K. Stern, President of the American Institute of Cooperation, said in announcing publication of "Farmer Cooperatives and Scouting," to encourage farm business organizations to offer leadership and approval of officials of the Boy Scouts of America.

"Even though the many effective national organizations working with rural boys are constantly increasing their memberships and rural activities, it is sad to state that less than half of eligible rural boys are enjoying the training, character-building, and recreational benefits available to them through organized activities," Mr. Stern said.

"In an effort to show how farmer cooperatives can help rural boys and strengthen communities by sponsoring Scouting activities, the Institute, which is the national educational and research agency of farm business agencies, has published a 24-page illustrated booklet explaining the benefits of Scouting, and how cooperative leaders can organize a Cub pack, Boy Scout troop, or the Lone Scout plan for isolated country boys. The booklet shows examples of co-op-Boy Scout joint activities now in progress in several states, and emphasizes the benefits from such programs."

Junior home demonstration work in Broward County is fortified with a six-point program, says Home Demonstration Agent Mrs. Laura Williams. The 4-H girls are stressing home improvement, health, clothing and textiles, home gardens, food and nutrition and poultry.

. . . Notes Of The Trade . . .

Swedish Markets To Get Florida Juice Crystals

Orange Crystals, Inc., made its first major export shipment of a new four-ounce retail package recently when a total of 1625 cases of instant grapefruit juice crystals was loaded aboard the M/S Thalatta at the Port of Tampa for delivery to Sweden.

The new four-ounce retail can makes one quart of juice. Until now, the crystals have been available only in one-pound cans for institutional use. For this particular shipment, special labels, printed in Sweden were used, to make it easy for the Swedish housewife to prepare pure juice in minutes.

W. E. G. Gallwey, president of Orange Crystals, Inc., said that the shipment to Sweden consisted of 1000 cases of orange crystals and 625 cases of grapefruit crystals.

"This is equal to about 5600 cases of canned juice, or 19,000 gallons of juice when reconstituted," he added.

Upon arrival in Sweden, the crystals will be delivered to grocery and fruit stores in all major cities throughout the country.

During its first complete year of operations, Orange Crystals, Inc., also has made shipments to more than a dozen other foreign countries, including Holland, Ireland, Afghanistan, Sumatra, the Belgian Congo, Egypt, Switzerland, Hong Kong, Ecuador and Chile.

Orange Crystals, Inc., uses a patented process to transform orange and grapefruit concentrate into tiny crystals, which are merely mixed with water to make fresh-tasting juice. The cans of crystals need no refrigeration or other special handling. and take only about one-fifth the shipping space occupied by liquid jucies.

The entire crystallization process takes less than a minute and a half, and is done under an almost complete vacuum.

Aside from saving valuable shipping space, the orange and grapefruit crystals have an extremely high retention of Vitamin C — 96 per cent, according to laboratory analysis. A leading hospital in Toronto recently tested the crystals and found they had a higher Vitamin C content than the average fresh oranges available there.

Wm. A. Leavell Joins Cameron & Barkley Co.

The appointment of William A. Leavell, Jr. as sales representative in Tampa for The Cameron & Barkley Co. was announced today. He will replace Percy L. Moore who has been promoted to the position of Manager of the expanding Orlando branch.

Mr. Leavell formerly owned and operated his own industrial supply and equipment company on the west coast of Florida. His extensive product knowledge coupled with his close association with industrial needs should be of great help to purchasing and plant operating people in the area.

Mr. Leavell is a graduate of the University of Alabama and received his masters degree in economics from George Washington University. He has been active in the American Legion, Lions Club, Fraternal Order of Eagles, and the Red Cross.

Mrs. Vandergrift Appointed Ladies Chairman Of FFVA

Mrs. Roy Vandegrift, Jr., Pahokee, has been appointed chairman of the Ladies Activities Committee for the

Mrs. Roy Vandegrift, Jr.

13th Annual Convention of the Florida Fruit and Vegetable Association, according to an announcement by Convention Chairman Luther Chandler, Goulds.

The Convention is being held this year at the Fontainebleau Hotel, Miami Beach on September 27,28, and 29.

The Ladies Activities Committee, appointed annually by the Convention Chairman, functions as official hostesses during the Convention and is in charge of entertainment for the visiting ladies and guests, according to Chandler.

Chandler stated, "It is a pleasure to announce Mrs. Vandegrift's appointment and acceptance as chairman of the Ladies Activities Committee. An excellent social program and real southern hospitality can be expected by all guests at our 13th Convention."

Mrs. Vandegrift is the wife of Roy Vangegrift, Jr., a director of the Association. This is her second year as chairman of the Ladies Activities Committee.

Demonstration of FMC Volume Filler At Snively Groves, Inc.

A demonstration of a new FMC Volume Filler was recently held at the Snively Groves, Inc., plant at Winter Haven, Florida. Packers were invited to visit the demonstration to view volume filling of cartons under actual operating conditions. During the day-long demonstration over a hundred interested packing house executives visited the demonstration and received first hand information on the volume filling operation from FMC personnel in attendance.

This new machine was obtained from the FMC Packing Equipment Division in Riverside, California. Many machines of this type are in use in California operations and they report a saving of 74% on packing costs. This is based on a full wrap nailed box of 1-2/5 bu. capacity. A good portion of the savings is in the container, plus the labor of wrapping and nailing.

In Florida, container costs are comparable but wrapping is no longer done so that savings will be principally connected to the labor costs of packing fruit.

Florida has many more varities of citrus, more and various container sizes and consequently more problems connected with a major change in established packing procedures than was true in California. The Volume Filler demonstrated was therefore revised to compensate for these conditions.

Experiments on this equipment have been conducted at the Snively Groves plant during the past spring and a detailed report has been prepared of the results. Copies of this report can be obtained, on request, from the Florida Division, Food Machinery and Chemical Corporation, Lakeland, Florida.

1955 Fertilizer Consumption 1.3 Percent Below 1954

. . . By . . .
WILLIAM S. RITNOUR

Fertilizer consumption in the United States during the calendar year 1955 was a near-record 20,416,410 tons, according to a study just completed by the National Plant Food Institute. This represents a decrease of 1.3 percent from the all-time record of 1954 when the revised estimate amounted to 20,679,026 tons.

Although total tonnage in 1955 dipped slightly from the preceding year, indications are that consumption of actual plant food (nitrogen, phosphate and potash) continued to increase.

In making this study the Institute obtained, wherever possible, consumption figures for both fertilizer and contained plant food. However, the latter were not available on a calendar year basis in a substanial number of States. Nevertheless, figures from States reporting both types of data indicated an increase in the average plant food content of fertilizer. In 1939 the average plant food content of a ton of fertilizer was 20.3 percent. Today it averages almost 28 percent. This means that above 5,700,000 tons of actual plant food were applied to the Nation's soils in 1955.

The consumption pattern in the Middle West shows a 2.4 percent decrease with the major part of the decrease occurring in the drought area of the West North Central States.

The South Central region, suffering from poor weather conditions, showed a major decrease of 10.7 percent from 1954 figures.

The only significant increase was in the Western States where 1955 figures were up 12.7 percent over 1954. Smaller increases in 1955 over 1954 occurred in the New England, Middle Atlantic, and South Atlantic areas.

Fertilizer consumption in six States continues to exceed one million tons and accounts for more than a third of the total U. S. consumption: North Carolina, traditionally the leader, 1,791,258 tons; Florida, 1,450,101 tons; Georgia, 1,299,654 tons; Indiana, 1,099,942 tons; Ohio, 1,088,467 tons; and Alabama, 1,039,160 tons.

Percentagewise, New Mexico showed the greatest 1955 gain over 1954, 21.8 percent.

In the 10-year period since 1946, fertilizer consumption in the United States increased more than 37 percent. The greatest increase occurred in the West North Central States, where 1955 consumption was more than 169 percent greater than in 1946. The only section where consumption has declined during this 10-year period is New England with a 23 percent decrease.

Figures used in this report are for the calendar year 1955. The official U. S. Department of Agriculture fertilizer consumption reports are for fiscal years ending June 30.

This report also differs from the USDA report in that tonnages of certain materials are not included to the extent it has been possible to eliminate from available information. Materials excluded are limestone, phosphate rock, colloidal phosphate, basic slag, secondary and trace elements, gypsum, sulfur, and other soil amendments.

U. S. FERTILIZER CONSUMPTION BY REGIONS—1955 WITH COMPARISONS
(Short Tons)

REGION	1946 Consumption (Tons)	Per cent of Total 1946	1954 Consumption (Tons)	Per cent of Total 1954	1955 Consumption (Tons)	Per ctnt of Total 1955	Per cent Increase or Decrease 1955 over 1946
New England	559,299	3.7	423,408	2.1	432,278	2.1	-22.7
Middle Atlantic	1,335,056	8.9	1,549,930	7.5	1,575,320	7.7	+18.0
East North Central	2,440,161	16.4	4,083,864	19.7	4,056,342	19.9	+66.2
West North Central	723,240	4.9	2,070,373	10.0	1,950,262	9.6	+169.7
South Atlantic	5,939,821	39.9	6,598,710	31.9	6,743,630	33.0	+13.5
South Central	3,003,628	20.2	4,486,157	21.7	4,006,214	19.6	+33.4
Western	891,117	6.0	1,466,584	7.1	1,652,364	8.1	+85.4
United States	14,892,322	100.0	20,679,026	100.0	20,416,410	100.0	+37.1

ANNUAL FERTILIZER CONSUMPTION IN THE UNITED STATES
(Short Tons)

YEAR	TONNAGE	YEAR	TONNAGE	YEAR	TONNAGE	YEAR	TOTAL TONNAGE
1880	1,150,000	1919	6,626,000	1931	6,354,000	1943	11,463,000
1890	1,950,000	1920	7,177,000	1932	4,385,000	1944	12,055,000
1900	2,200,000	1921	4,863,000	1933	4,908,000	1945	13,202,000
1910	5,453,000	1922	5,671,000	1934	5,583,000	1946	14,892,000
1911	6,024,000	1923	6,445,000	1935	6,276,000	1947	15,039,000
1912	5,767,000	1924	6,826,000	1936	6,931,000	1948	15,980,000
1913	6,337,000	1925	7,334,000	1937	8,226,000	1949	16,449,000
1914	7,100,000	1926	7,329,000	1938	7,548,000	1950	17,984,000
1915	5,324,000	1927	6,844,000	1939	7,707,000	1951	18,826,000
1916	5,125,000	1928	7,986,000	1940	8,249,000	1952	20,077,000
1917	5,926,000	1929	8,012,000	1941	9,183,000	1953	20,231,000
1918	6,467,000	1930	8,222,000	1942	9,949,000	1954	20,679,000
						1955	20,416,410

Citrus Mutual Expands Forces For Work At Grower Level

Two men have been added to Florida Citrus Mutual's field force, one as a replacement and the other as an expansion of this group, it was announced by Lew Marshall, head of Mutual's grower division.

The new workers are Bryan H. (Red) Phillips of Ocala and Jack Nelson of Umatilla.

Phillips succeeds R. H. (Buddy) Nahm of DeLand, who resigned a short time ago. Nelson represents an expansion of this branch of Mutual which now comprises seven men who keep Mutual informed of prices and other activities at the grower level.

"We are glad to welcome both of these capable men as new members of the Mutual family," General Manager Robert W. Rutledge said today in commenting on the appointments.

LEARN TO MEASURE

St. Lucie County first and second year 4-H Club girls have been very much interested in giving demonstrations showing the proper way to measure flour, shortening, salt, liquids and so on, says Mrs. Mildred T. Marsh, home demonstration agent. measures

Products From Citrus Peel

R. W. KILBURN
FLORIDA CITRUS CANNERS COOPERATIVE
LAKE WALES, FLORIDA
AT MEETING AMERICAN ENGINEERING CONFERENCE, WINTER HAVEN, MARCH 27

Almost four million tons of citrus fruit were used by the Florida processing plants last year. Juice obtained from citrus represents only approximately half of the weight of the fruit. Two million tons of peel, pulp and seeds, accumulated yearly at processing plants, presents a challenge and an opportunity. This is a large amount of raw material, readily available, concentrated in a relatively small number of locations, and produced over a period of time which makes possible economical handling and processing.

Research chemists have recovered scores of different compounds from citrus peel. Hundreds more have been derived by chemical action. This paper will not attempt to catalogue all these interesting materials. They represent only a portion of the problem of profitable utilization of peel. Markets must be found, created, or expanded to form a sound reason for production. Production methods must be engineered to control production costs by favorable levels. To make a silk purse from a sow's ear is a fascinating study for the chemist. An investor would not feel the achievement to be successful unless the purses could be produced in volume and sold at a profit.

Perhaps a sound method for presenting the evaluation of production of useful material from citrus peel would be to examine a half dozen products which have been successful from the viewpoint of the investor. The reasons for success may point out guiding principles for development of additional products.

Historically the utilization of citrus peel has been, and still is, dictated by the necessity for disposing of cannery residues. Cull fruit and peel from the processing plants was hauled to outlying areas and dumped in pasture land during the early years of the industry. As the citrus processing industry grew, the disposal of waste became increasingly difficult. Fermentation of the accumulated peel created offensive odors and attracted insects. Hauling became too expensive.

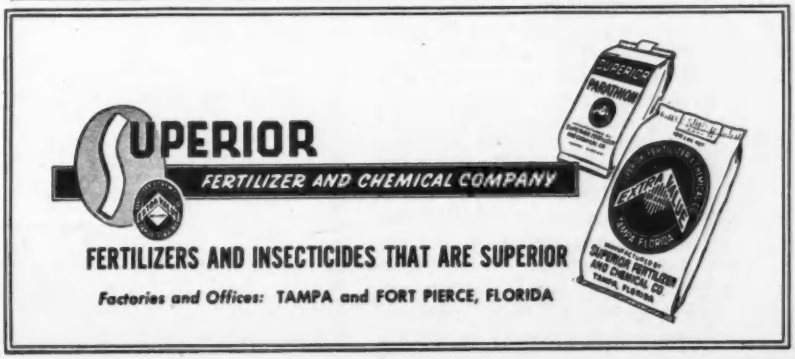
It had been long noted that citrus fruit or peel was an acceptable food for cattle. Studies were made to discover whether citrus peel could be dried to make a satisfactory animal feed which would command a price sufficient to make production profitable. The material could not be dried readily without some processing. Peel contains approximately 80 percent moisture but very little of this is in the free state. Pressure will remove only a relatively small amount of liquid from peel because the bulk of the moisture is held by loose chemical bonding. It was found necessary to break down the pectinous structure of peel to release moisture for removal by pressure and facilitate evaporation by heat. The drying of untreated peel leads to formation of a hard, horny structure similar to dehydrated glue.

The method of preparing peel for drying is to treat it with an alkaline agent. Pectinous material in the peel is broken down through combined chemical and enzymatic action Slaked lime is the cheapest available source of alkali and is universally used in processing peel. Lime also has the additional function of changing pectin to an insoluble form. Chopped, limed peel is allowed to stand until the reaction has taken place to the desired degree. The peel may be dried in this condition or approximately half of the water can first be removed with a mechanical press. The moisture content of the press cake is less than the unpressed peel by only a small amount because of the removal of large amounts of soluble solids with the water. The press liquor contains a considerable portion of the nutrients in the peel, making recovery desirable. Any sizeable discharge of press liquor into surface water ways causes excessive pollution.

Plants pressing treated peel have installed evaporators to manufacture citrus molasses. On a dry weight basis, citrus molasses has approximately the ame nutritional value as pulp except for ether extract. A wide discrepancy developed in the price of molasses as compared with dried citrus pulp because of the relatively smaller demand. Since the two products are practically equivalent nutritionally, producers now incorporate essentially all of the citrus molasses in pulp. It is often advisable to make citrus molasses, rather than dry the unpressed peel. This gives greater flexibility of marketing when the price of molasses is favorable. It is more economical to evaporate moisture in multiple effect evaporators than in most pulp dryers.

Citrus peel is a complex mixture of organic compounds. The various components can be separated from each other by physical and chemical methods. This process of fractionation greatly enhances the value of peel over that obtained by simple drying as cattle feed. The field of utilization is greatly broadened because of diversified application of the various components. Next to water, the most common constituent of citrus peel is sugar. Economical recovery of sugar or conversion into such products as yeast and alcohol is limited in value by competing agricultural products containing higher concentrations of sugar. It is far more profitable to look for components in citrus which are either unique to citrus or present in large amounts comparable to competitive products.

Cold pressed citrus peel oil was the first commercially important material separated from citrus peel. The manufacture of peel oil pre-dates all juice products. Oil is located in tiny sacs on the surface of the fruit and



is sometimes removed by a grating or rasping process from the whole fruit. A more common method is to crush peel, separated from the fleshy portion of the fruit, to express the oil. Oil removed by most methods is dispersed in the form of fine droplets in an aqueous liquid. Centrifugal force is generally used to break the emulsion and separate the oil from water.

Peel oil is quite volatile, immiscible with water, and easily recovered by steam distillation. Steam distilled lime oil is a very common article of commerce and produced in large amounts.

Citrus peel oil is a good example of a sound guiding principal for fractionation of citrus peel into valuable components. Citrus oils are used to give food products a citrus flavor. Lime, orange and lemon are the most widely used but small amounts of grapefruit and tangerine oil are also produced. The popularity of citrus for eating as fresh fruit or for preparation of juice and beverages, creates a ready demand for citrus flavoring material. Uniformity of quality of the oil can be maintained, making the material reliable. The oils can be produced in quantities sufficient to supply the demand at prices comparable to other flavoring material.

"Stripper oil" is another citrus peel derivative which possess advantageous characteristics not found in similar material. Press liquor, made by squeezing lime treated peel in a mechanical press, contains a considerable amount of peel oil. The oil distills off in the process of making molasses and can be recovered by condensing water vapor from the evaporator. The condensate separates easily into two phases because the emulsifying agent remains in the molasses. This oil, called "stripper oil," is a relatively pure compound known as d-limonene. Limonene has physical properties which make it useful in certain applications as a solvent or additive. Limonene is also a very reactive material and a great variety of chemical compounds can be formed. Stripper oil has a unique characteristic which makes it valuable as a starting material for organic synthesis; it is not a mixture of chemical isomers. The most common competing material is dipentene, made by distillation of pine stumps. Dipentene is a mixture of d&l-limonene which undergoes the same chemical reactions as stripper oil but yields a final product that is a mixture. Characteristic physiological reactions of pharmaceuticals, or odors and flavors, very commonly depend upon the chemical structure of the material so that a great difference is noted between the dextro and levo-rotary isomers. D-carvone has the odor of dill and l-carvone is the principal component of spearmint oil. For this reason, d-limonene is the only material used to synthesize l-carvone, synthetic spearmint oil. D-limonene would also command this advantageous position as a starting material for synthesis of a number of other products in the flavor and perfume fields.

The bioflavonoids, another class of material recoverable from citrus peel, have generated a considerable amount of interest. Bioflavonoid is a general term, applied to a great family of glycosides of flavanones found in plant materials. Citrus flavonoids were commonly called Vitamin P or citrin in the past. Each variety of citrus produces a characteristic flavanone mixed with other pigments. The value of these bioflavonoids have been demonstrated in clinical tests and the demand will probably increase.

The flavanones are usually somewhat insoluble in water but form soluble compounds with dilute alkali. Dilute lime slurry may be used to extract the material from chopped peel or press liquor may be used. The solution is clarified by filtration and a crude mixture of bioflavonoids precipitated by acidification. They may also be extracted from press liquor or citrus molasses with organic solvents. The crude mixture is frequently used in pharmaceutical preparations or it may be purified by reprecipitation and modified by chemical reaction. The study of materials synthesized from the flavanones offers a considerable field of opportunity. Workers at the Florida Citrus Experiment Station have prepared dyes with superior characteristics by means of reaction of various materials with the flavanones.

Another profitable field of utilization is the isolation and purification of material, available from other sources but present in citrus processing residue in concentrations which permit profitable recovery. Citrus pectin is the best known example. Pectinous material is one of the major constituents in citrus peel. Pectin can be removed from all varieties of citrus but lemon and orange are used exclusively for commercial preparation. Grapefruit peel readily yields high quality pectin but requires an additional processing step of water leaching to remove the bitter princi-

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Florida growers now consider magnesium a primary plant food in the same category with nitrogen, phosphorus and potash.

The recommendations of the Flordia Citrus Experiment Station at Lake Alfred, published in January 1954, stress the need for large application of magnesium for Citrus in soluble form and state that it is usually applied as a Sulphate.

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pal. The process of preparation of citrus pectin consist in general of chopping the peel, washing with water, cooking with dilute mineral acid to hydrolize proto-pectin, filtration to remove insolubles, and precipitation of pectin from the clarified solution by addition of alcohol or formation of an insoluble compound by addition of an aluminum salt. The crude pectin is purified by washing with acidified, aqueous alcohol. After drying and grinding, the jelly strength is tested and the strength standardized by addition of sugar in the proper amount. Modified pectins are finding increasing use in applications other than traditional jam, jelly and candy. Low methoxyl pectin, the primary commercial example, is used as a coating or binder as well as for making low sugar jells such as canned tomato aspic.

Citrus seed oil, a more recent development utilizing citrus residues, competes profitably with oil from other agricultural products. Citrus seed was originally separated from finisher pulp or recovered in the process of sectionizing grapefruit. Recent developments have made it possible to recover seeds from dried citrus pulp by means of air flotation. The seeds must be dry for stability in storage and for recovery of oil. The oil may be expressed from flaked seed meats by mechanical presses or removed by solvent extraction. Citrus seed oil, after proper purification, makes a very acceptable salad or margarine oil.

The field of utilization of products from citrus peel is wide open. A lot of work remains to be done to determine the possibilities which exist. The program for advancement can be broken down into three general parts.

1. Analysis of citrus peel, pulp and seed to determine kinds and amounts of compounds present. Isolation, purification and determination of chemical and physical properties of the compounds. Study of the data for listing compounds which are unique to citrus.

2. Chemical engineering studies of the most economical methods of isolating the various compounds from citrus residues. Similar studies on the economics of various chemical reactions for changing the characteristics of the compounds.

3. Marketing research on the utilization of the compounds and derivatives.

Probably the greatest opportunity for success lies not in the isolation of single compounds, but development of an integrated process for recovery of several. Overlapping operations reduce processing costs. The greatest need for information at the present time is in marketing research to evaluate present knowledge.

Suggested Literature:

Oils:

Ernest Guenther, "The Essential Oils." D. Van Nostrand Company, New York.

Pectin:

Z. I. Kertesz, "The Pectin Substances." Interscience Publishers, New York.

Bioflavonoids:

1. J. Q. Griffith, C. F. Krewson, and J. Naghski, "Rutin and Related Flavonoids." Mach Publishing Company, Easton, Penn.

2. Frtiz Mayer, and A. H. Cook, "The Chemistry of Natural Coloring Matters." Reinhold Publishing Corporation, New York.

Increased use of electricity on farms has led to lower average cost per kilowatt hour paid by farmers but somewhat higher monthly electric bills. An annual survey by the Crop Reporting Service of reports from farmers throughout the United States shows that increased use of electricity is general in all States and regions.

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Reports Of Our Field Men . . .

SOUTH POLK, HIGHLANDS, HARDEE, DeSOTO AND SARASOTA COUNTIES

C. R. Wingfield

The topic of conversation at the present is the Mediterranean fruit fly. Where did it come from? How long have we had them? How much of the state has it covered? How long will it take to get rid of them? The USDA and our State Plant Board will come up with answers to these questions I feel sure. This is a big problem and it needs the help of all to bring this pest under control.

The Valencia season is fast drawing to a close with very little fruit left in this section. The new crop is looking fine considering what it has gone through. Good crops over most of the area except those trees that suffered so badly from lack of moisture. We are having some rain but does not cover but a small area. At this writing (June 20th) we find it necessary to start irrigation pumps soon.

The Summer application is just about over and the grower must turn his attention to insect control. Rust Mite, Florida Scale, Purple Scale and some Red Spiders are found and while the oil period is here we must apply control for the one during the most damage. With dry weather as it is a careful survey should be made.

SOUTH HILLSBOROUGH AND MANATEE COUNTIES

J. D. Toll

Last year at this time, June 15th, this territory had received twice as much rain as this year. This past week the sky has remained cloudy and some sections have had showers. A heavy late bloom is anticipated after the Summer rains begin.

I have noticed considerable fruit drop in groves that have not been irrigated.

Heavy infestation of purple and red scale are building up in many groves. Growers using oil should not spray when trees are wilting or near wilting.

Most vegetable crops have been harvested. By the time this writing is in print most farm land will be cleaned up and cover crops planted and the tractors and equipment in the barn for a deserved rest.

Vacation time is here. We at Lyons hope you and your family will have a wonderful time on your vacation.

EAST HILLSBOROUGH AND PASCO COUNTIES

E. A. McCartney

Spotty rains last week in this section did some good. It looks as though our June rains have started at last. Most of the Valencias have been moved as of this date, June 1-8th, at fair prices. Marsh seedless grapefruit is moving again. Vegetables are about finished for this season.

We are a little late with our Summer fertilizer on account of the long dry spell, but we are moving along in good volume now.

A few melon growers came out in good shape but the majority have had a rough time. This was one of those years that weather conditions were against the growers and nothing could be done about it.

Several thousand acres of citrus trees have been set out in Hillsborough, Pasco and Citrus counties this past season — mostly oranges, early and late — some tangerines in Hernando county.

HIGHLANDS AND POLK COUNTIES

J. K. Enzor, Jr., & R. E. Lassiter, Jr.

We have been receiving spotted rains for the past few weeks in this area. In some places this rainfall has been fairly good, however, in others there is still a need for more water.

We have observed quite a build up in the rust mite population in many groves in the last few weeks. Growers should be checking closely for this mite. The scale problem is serious in many groves, however particular caution should be used in applying oil where there has not been sufficient moisture. It should be noted that where oil is applied on heavy infestations of rust mite, the grower should check closely following the oil spray for a reinfestation of rust mite.

Most of the growers in this area have finished their Summer fertilizer application. The young trees should be receiving fertilizer throughout the Summer months in order to assure maximum growth.

NORTH CENTRAL FLORIDA

V. E. Bourland

We still have dry weather, and don't look as we are going to get much this month. Some groves are suffering very badly on flat land. Every one irrigating that can. Young trees are being watered regular.

Most all the fruit has been picked in this section, and most of the groves have plenty of fruit set now for next season.

Melon crop is about over. Where growers could water they made very good, and prices fair.

Pastures are all needing rain. Some are irrigating, but cows in general are looking good.

WEST HILLSBOROUGH AND PINELLAS COUNTIES

J. A. Hoffman

Dry weather still seems to be the main conversation throughout this section. There has been a few scattered showers during the past week, but not enough to bring much relief to citrus growers. The dry weather has delayed the Summer application of fertilizer and planting of cover crops.

Rust mite and scale are both very active at this time. A sulphur dust or spray should be applied as soon as possible where rust mite and scale are active so as a scalicide can be applied soon as permitted.

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Uncle Bill Says:

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So today when we run into troubles which we think is most disheartenin' it might pay us to think back about how our ancestors managed to git along . . . and how they surmounted troubles which was harder to lick than those we run into.

Today whenever troubles come to plague us citrus and vegetable growers we suffer it's true . . . but we have the advantage of having modern science and modern equipment to help us combat whatever troubles, pests and weather may bring to us.

And when it comes to growin' crops we're so fer ahead of what our predecessors had to deal with there jist ain't no comparison . . . of course a lot of the farms in those days was on virgin soil, but they'd have grown a lot bigger and better crops if they'd had the advantage of modern commercial fertilizers to help make their growin' job simpler and better.

So although we may have plenty of problems in this business of producin' fine crops . . . and we'll probably always have problems . . . still each passin' year brings us answers to a lot of these problems and as time continues we find more and better answers to any problems which confront us.

In the meantime we suggest that every grower remember the Lyons slogan . . . "Lyons Fertilizers Produce Maximum Crops of Finest Quality" . . . we found out over a long period of years that Lyons Fertilizers will do jist exactly what their slogan promises.

Florida Citrus Mutual Holds Annual Membership Meeting, Winter Haven

The Mediterranean fruit fly, considered by many persons the most serious potential threat ever to face Florida's huge citrus industry, holds the spotlight at Florida Citrus Mutual's eighth annual membership meeting at Winter Haven.

A group of State and Federal experts will be on hand to answer questions from growers, with Rutledge as moderator to relay the inquiries to those best qualified to answer them.

On the panel were Ed. L. Ayers, commissioner of the State Plant Board; Wilbur Charles, who heads up the Medfly campaign for the plant board; Dr. W. L. Popham, director of crops regulatory programs of the Agriculture Research Service, U. S. Depatment of Agriculture; Eugene P. Reagan, chief of the plant quarantine section and L. F. Steiner, entomologist and spray expert with the plant pest control branch, also of the U. S. Department of Agriculture.

On tap during the brief business session was the formal seating of the 21 members of the board of directors who will serve during the coming year. Only three changes in membership are involved, with 18 directors renamed for another term.

Reports were given by Conner and Rutledge on Mutual's operations during the season just coming to a close and plans for the future.

CAN IRRIGATION LESSEN CITRUS FRUIT DROP?

(Continued from page 8)

ness of soil moisture control should be investigated.

These data, though not conclusive, point to the possibility of a critical soil moisture-fruit retention relationship which may have great influence on whether irrigation of citrus can be made a paying proposition during years when droughts are not so severe as to require water to save the tree.

In summary, it was found that irrigation based upon a soil moisture tension measurement resulted in a significant increase in fruit retention. Other soil moisture tension and irrigation timing experiments are needed to find the point of maximum profit for the irrigation of citrus under humid conditions.

Table 2.—Soil moisture tension at various depths and position under 8 Hamiln orange trees at times when half were irrigated.

Treatment	Tree No.	Tensiometer No.	Position	Depth	Soil Moisture Tension — Cm. H_2O_1 4/25*	4/27	5/9*	5/11	6/1*	6/6	6/11
				Feet							
Irrigation	1	1	Trunk	1	660	54	610	40	306	694	126
		2	Trunk	2	316	58	388	56	267	634	100
		3	Canopy	2	528	58	370	514	712	.....	.....
	4	10	Trunk	1	814	63	850	44	802	730	220
		11	Trunk	2	382	60	578	63	252	712	172
		12	Canopy	2	.....	50	790	60	800	792	100
	8	22	Trunk	1	812	94	844	86	805	830	674
		23	Trunk	2	690	68	762	258	478	766	390
		24	Canopy	2	510	52	474	54	692	754	94
	13	37	Trunk	1	800	50	.....	.....	826	806	610
		38	Trunk	2	388	64	375	62	148	634	100
		39	Canopy	2	692	554	270	78	490	668	116
No Irrigation	3	7	Trunk	1	.....	.....	.....	.....	564	720	.....
		8	Trunk	2	776	753	768	772	.....	.....	.....
		9	Canopy	2	.....	.....	.....	.....	.....	.....	.....
	6	16	Trunk	1	678	719	782	785	496	696	.....
		17	Trunk	2	284	392	778	786	.....	.....	.....
		18	Canopy	2	156	173	362	414	154	282	468
	7	19	Trunk	1	782	812	.....	.....	572	776	.....
		20	Trunk	2	646	715	.....	.....	.....	.....	.....
		21	Canopy	2	100	118	298	354	.....	.....	.....
	10	28	Trunk	1	740	800	.....	.....	.....	.....	.....
		29	Trunk	2	220	295	738	765	.....	.....	.....
		30	Canopy	2	350	360	575	610	.....	.....	.....

*Irrigation dates; approximately 3 inches per irrigation.
1. Blanks indicate that the tensiometers had gone out of operation after reaching a maximum reading of around 800.

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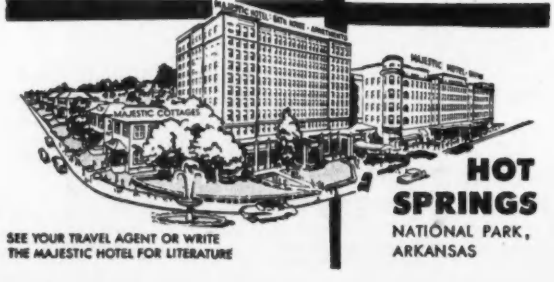

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AN IMPORTANT MESSAGE FROM THE SECRETARY OF THE TREASURY

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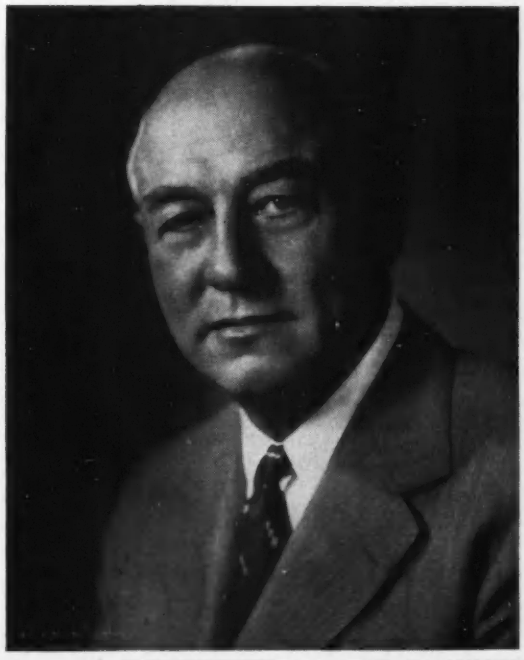
How the public, the magazine publishers and the U. S. Government cooperate to help keep the nation's economy growing always stronger

As a reader of this magazine, the chances are that you belong to a "three-way partnership" dedicated to intelligent saving and a sound economy. For you probably buy United States Savings Bonds. Nearly 40 per cent of the families in America own them. Most Bond-owning families have saved enough in this way to pay for a serious illness, to provide something for old age, to make a down payment on a house or take a long trip. And perhaps most important, these families have the wonderful feeling of security that the ownership and holding of these Bonds bring.



Americans today are buying Savings Bonds at an annual rate of more than $5,000,000,000. In the time it takes you to read this page, approximately one minute, America will buy $10,000 worth of Series E and H Bonds!

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Full credit for making Bond-buying a national habit is due that "three-way partnership"—the American citizen, the Government, and the volunteer groups, such as the magazine publishers, who bring buyer and seller together through the pages of their publications.

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For so effectively promoting the national welfare I wish, on behalf of the Government, to extend to the magazine publishers our most sincere thanks.

G. M. Humphrey

Secretary of the Treasury

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